PREFERRED CITYWIDE REMEDY

1. Introduction

This document[1] presents the City of New York and School Construction Authority's Preferred Citywide Remedy to address PCB exposures in the school environment. The Preferred Citywide Remedy appearing below responds to EPA's input, as informed by the independent peer review committee and the public as described in the CAFO.

After the finalization of the Preferred Citywide Remedy, the City of New York and School Construction Authority and the EPA will meet to negotiate a Citywide PCB Management Plan. While the specific details of the Citywide PCB Management Plan will be addressed during the negotiations, pursuant to the CAFO, the parties have agreed to the following principles and requirements to guide the negotiations:

1. PCB caulk is a national issue and EPA will consider any national or regional policies in developing and accepting a plan for New York City;

2. Given the large number of Relevant Schools, EPA agrees that any Citywide PCB Management Plan shall be structured in a phased manner, prioritizing work based on factors including, but not limited to: (i) the condition of caulking; (ii) the potential for exposure; (iii) the concentrations of PCBs contained in caulking; (iv) the ages of the children within a school building; or (v) any other such factors that the parties may agree are appropriate for prioritizing work.

The parties also agree that the Citywide PCB Management Plan shall include:

1. A schedule for remedial action that maximizes health protection consistent with City resources and avoidance of disruption of school activities.

2. An initial focus on schools with the highest potential exposure risks.

3. Cost-effective strategies to reduce PCB exposures.

4. Reasonable testing or other methods of evaluation to characterize PCBs in Relevant Schools to help set priorities for remediation.

5. Reduce potential PCB exposures through BMPs, encapsulation or removal of caulk.

6. Where necessary for risk reduction, investigation of potential significant non-caulk sources and appropriate remedial action.

[1] The City of New York and the School Construction Authority initially submitted this document as Section 4 of the Summary Report for the New York City School Construction Authority Pilot Study to Address PCB Caulk in New York City School Buildings, dated May 24, 2013.

7. A Citizens Participation Plan containing steps to inform and obtain input from the public concerning the Citywide PCB Management Plan and its implementation.

With these agreements in mind, and also in light of EPA's input in early 2015, the proposed Preferred Citywide Remedy offers a reasoned approach to efficiently manage PCBs in the Relevant Schools by addressing PCB ballasts and associated light fixtures, Best Management Practices, PCB caulk, and contaminated surface soils in Outside Exposure Areas. Moreover, Section 7 below proposes additional studies, namely, targeted risk-based air sampling in a limited number of schools and additional study of passive air sampling as a technique. It is anticipated that any Citywide PCB Management Plan will be subject to change based on ongoing data collection and data evaluation.

The specific elements of the proposed Preferred Citywide Remedy are presented in the subsections below.

2. PCB Ballast and Associated Light Fixture Management and Replacement

The Pilot Study determined that the removal and replacement of PCB-containing light ballasts and associated fixtures is a successful remedial measure for lowering PCB levels in indoor air where concentrations were found to exceed the USEPA air guidance values. PCB-containing light fixture ballast replacement is effective where a supplemental remedy is necessary, and also as a primary remedial measure. Accordingly, the proposed Preferred Citywide Remedy includes PCB-containing light fixture ballasts and associated fixtures replacement at the Relevant School Buildings. PCB-containing light fixture ballasts and associated fixtures replacement are being implemented as part of the City's ongoing program. All light fixture replacements projects will be completed by December 31, 2016.

2.1 Light Fixture Removal Program

2.1.1 Identified Buildings and Light Fixture Removal Schedule

In April 2012, 738 buildings were identified with T12 lighting fixtures that may contain PCBs. Since that time, buildings with T12 fixtures have been both added and removed from the list for various reasons (e.g.; T12 fixtures found in non-classroom locations such as trophy cases; lease terminations). As of November 1, 2014, the total number of buildings with T12 lighting fixtures was 781.[2]

In October 2013, the light fixture replacement project was expanded to also include High Intensity Discharge ("HID") fixtures. HID fixtures are found in limited areas of schools, such as gyms, auditoriums, and shop rooms, and may also contain PCBs. Despite negative test results in the HID fixtures tested, the City has committed to replacing all HID fixtures installed before 1980 unless construction records verify that these fixtures have already been replaced. As of November 1, 2014, 178 buildings that do not currently contain any T12 fixtures have been

[2] *See* 2014 Report Pursuant to Local Law 69 of 2011 ("2014 Local Law 69 Report"), Appendix A, *available at* http://www.nycsca.org/Community/Programs/EPA-NYC-PCB/PCBDocs/LL69ReportFinal11.14.14.pdf

identified as having HID fixtures that may contain PCBs, including 56 buildings that have already had all T12 fixtures removed.[3]

As of April 6, 2015, light fixture replacements have been completed in 408 buildings (housing 694 schools and programs). The list of completed buildings is posted on SCA's PCBs website and is updated regularly as the replacements progress.[4] The schedule for completing the remaining light ballasts removals is included in Appendix D to the annual Report Pursuant to Local Law 69 of 2011, also available on SCA's PCBs website.[5] All light fixture replacements projects will be completed by December 31, 2016.

Since the light ballast removal program commenced, the New York City Department of Education (DOE) also identified 18 buildings that contained remote ballast panels, which are electrical cabinets containing ballasts that power adjacent T12 or HID light fixtures. As of November 2, 2014, all of these ballasts have been removed and associated staining was also removed.[6]

2.1.2 Methodology

The following presents an overview of the fluorescent light fixture and PCB-containing ballast removal methodology. Please note that additional protocols are required if the associated electrical wiring is found to be an asbestos-containing material.

The furniture and all other movable items are either removed from each room or moved to the side. The contractor then installs three (3) polyethylene sheeting flaps on each doorway and seals all openings/penetrations in the work area including exhaust and supply ventilation system vents. Electrical power to the light fixtures is de-energized and locked out/tagged out. The fixed objects within the work area are enclosed with a minimum of one layer of 6-mil polyethylene sheeting sealed airtight with tape. The contractor then installs six-mil polyethylene sheeting on the floor directly beneath the light fixture(s) and extending approximately five (5) feet in all directions. Non-movable objects within this five foot area are covered with one layer of sheeting.

The contractor workers, wearing PPE, then remove the lamp cover or grille from each light fixture exposing the fluorescent lamps. The fluorescent lamps are removed and the ballast enclosure cover is then removed, exposing the ballasts. The exterior of the ballast and the interior exposed section of the light fixture including housing (with ballast removed), cover and wires are visually inspected for evidence of any leakage or staining.

If leaking or staining is identified on the ballast and/or light fixture, the ballast is removed and placed directly in the authorized waste container (i.e., leaking PCB ballast drum), and the light

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[3] *See id.* at page 2.
[4] *See* "Completed Lighting Fixture Replacements," posted April 6, 2015, *available at* http://www.nycsca.org/Community/Programs/EPA-NYC-PCB/PCBDocs/CompletedLightingFixtureReplacements.pdf
[5] *See* 2014 Local Law 69 Report, Appendix D, *available at* http://www.nycsca.org/Community/Programs/EPA-NYC-PCB/PCBDocs/LL69ReportFinal11.14.14.pdf
[6] *See id.* at page 3.

fixture is wrapped in two layers of clear six-mil polyethylene sheeting, placed in an appropriate waste container and disposed of as PCB remediation waste.

If no leaking or staining is identified on either the ballast or light fixture, the ballast is removed and placed directly in the authorized waste container (i.e. non-leaking PCB ballast drum), and the light fixture is recycled.

All remediation work takes place outside of regular school hours, as required by asbestos abatement protocols and to minimize the disruption to students and staff.

2.2 Response to Potentially Leaking Ballasts at the Schools

In addition to the on-going PCB-containing light ballast and associated fixture replacement program described above, the Division of School Facilities (DSF) will continue to implement a program whereby existing T12 lighting fixtures are inspected on a regular basis by custodial staff for evidence of any brownish-black residue on any of the following: light diffuser (lens), light housing, or any area directly below the lighting fixtures (e.g. furniture or floor). This inspection includes an external observation of all T12 fixtures in the facility, including those that may be present in classrooms, offices, corridors, stairwells, labs, cafeterias, resource rooms, maintenance areas, and storage areas.

If light ballast residue or other evidence of a leak is found, the Custodial Engineer submits a high priority work order to the DSF's Environmental Health and Safety Unit (EHS). Upon receipt of the work request, EHS dispatches DSF's environmental consultant to visit the school and inspect the reported condition within 48 hours.

The environmental consultant and an electrician open the fixture and check to see if there is a "non-PCB" label identifying the ballast as not containing PCBs. Absent that label or stamp, the ballast is assumed to contain PCBs. The fixture is also inspected for signs of old stains or residue, and if found, the fixture is removed (even if the ballast is labeled non-PCB). The environmental consultant checks for any leakage from the ballast or residue on the fixture and safeguards the area around the work area by placing double layers of plastic directly below the fixture(s).

If leaks are observed, the fixture and the intact ballast or the ballast alone (if only the ballast has PCBs and there are no stains on the fixture) is removed by the electrician. If the consultant sees that the stain does not emanate from the fixture, then they report the incident as a non-PCB leak. (New ballasts and/or fixtures are installed at a later date by the Division of School Facilities.)

Fixtures are wrapped in 6-mil polyethylene sheeting and labeled and manifested as per US DOT and US EPA regulations. Ballasts are placed in properly labeled US DOT rated 55-gallon drums. All ballasts and fixture equipment removed from fixtures with unlabeled ballasts are presumed to contain PCBs.

Refer to the applicable New York City Department of Education, Division of School Facilities, Office of Building Services Circular No. 4– 2010/11, "T-12 Ballast Inspection Protocol," for all custodial engineers and building managers, dated April 11, 2011.[7]

2.3 Response to Ballast Fluid Leakage Outside the Fixture or Visible Smoke Emissions From Ballasts at the Schools

The following procedures are in place and will continue to be implemented for the limited cases when T12 ballast leakage occurs outside the fixture (e.g. housing or diffuser) or when smoke is emitted from ballasts.

Upon notification, the Custodial Engineer (CE) or Building Manager (BM) immediately reports to the location to inspect, and the following measures will be taken:

- Shut off the power to the fixture; and
- Call the incident in to Division of School Facilities (DSF).

DSF will notify the EPA within 24 hours and dispatch an environmental response contractor within 48 hours of the CE/BM's reporting of the leak or the smoke condition. Also, within 48 hours, DSF will inspect the reported location and the T12 fixtures in the rest of the building. DOE will provide the school Principal with a letter to backpack to parents, generally within 24 to 48 hours of the CE/BM reporting the condition.

The environmental contractor will remove the ballasts and/or fixtures and any additional impacted items will be cleaned or removed and disposed. As part of the corrective action, the environmental contractor will aggressively ventilate the space to ensure a minimum of 20 complete air exchanges in the room.

An environmental consultant will collect wipe samples from the impacted area at the conclusion of the remediation process. When laboratory results for the wipe samples are below the regulatory standards, the EPA and school administration will be notified that the space can be reoccupied. In instances where the wipe samples are above the regulatory standards, DSF will re-clean and resample until acceptable results are achieved.

Following the identification of a ballast leak or smoke condition at a school, that school will be placed in priority Category 1 for ballast replacement. Also following the identification of a leak or smoke condition, DSF will comply with notice and reporting requirements set forth in applicable local laws (Int 0563-2011, Int 0566-2011).

Refer to the applicable DOE Re-occupancy Protocol for Ballast Fluid Leakage Outside the Fixture or Visible Smoke Emissions From Ballasts, submitted to EPA on April 23, 2013.[8]

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[7] *Available at* http://www.opt-osfns.org/nycdsf/View.aspx?v=110.

[8] *See* 2014 Local Law 69 Report, at 5-6, *available at* http://www.nycsca.org/Community/Programs/EPA-NYC-PCB/PCBDocs/LL69ReportFinal11.14.14.pdf

3. Removal of PCB Caulk and Other Materials

TSCA requires that PCB bulk product waste be removed or managed through a risk-based waiver upon EPA's approval. In accordance with EPA Region 2 guidance to the City (through discussions in early 2015) regarding EPA's national interpretation of the TSCA regulations, the City will remove all PCB bulk product waste identified by direct material sample analysis. A list of these materials, and a Work Plan for their removal, are included as attachments to this Report.

Also consistent with EPA Region 2 guidance to the City (through discussions in early 2015) regarding EPA's national interpretation of the TSCA regulations, the City is seeking a risk-based approval from EPA pursuant to the PCB TSCA regulations, 40 C.F.R. § 761.61(c), to manage in place other building materials containing PCB remediation waste. The Pilot Study wipe sampling has shown that the City's Best Management Practices, discussed below, are effective at managing risks from PCB dust from building materials. The Pilot Study also showed that all but one of the five Pilot Schools demonstrated airborne concentrations consistently below the EPA guidance in primary exposure areas after the light ballasts had been removed and Best Management Practices implemented.[9]

Thus, the evidence from the Pilot Study clearly supports a conclusion that potential exposure risks from PCB-containing building materials can be safely mitigated through the remedial measures that the City is implementing. A risk-based approval is also appropriate since the City will continue to remove any PCB-containing materials identified through the SCA's capital projects, discussed in section 5 below. Such a waiver is also consistent with the PCB cleanup plan approved by EPA's Region 9 for the Santa Monica – Malibu Unified School District.

4. Best Management Practices

The City of New York has developed a set of Best Management Practices (BMP), which was approved by the EPA in April 2012. This includes employing strategies for managing PCB caulk and ensuring safe and proper operation of all heating, air conditioning, ventilating and similar equipment (collectively "HVAC"). The BMPs are a set of protocols that, when implemented, help to mitigate exposure to PCB caulk through the use of regular inspections, stringent cleaning methods, and maintaining essential building systems (e.g., HVAC systems). The BMPs also include measures and practices to be used to protect interior PCB caulk from accidental damage and to identify the potential for deterioration requiring further action on an ongoing basis during school maintenance, repair and renovation. Finally, the BMPs reference remediation of deteriorated PCB caulk by removal and replacement, patch and repair, or encapsulation. While the BMPs were designed with a focus on deteriorated caulk, the detailed cleaning and HVAC maintenance provisions of the BMPs will be performed throughout all schools—not just in areas where deteriorated caulk has been identified—and therefore these BMPs should reduce exposure

[9] The only exception was P.S. 199M. Currently, carbon filters are being used at P.S. 199M, and air levels have recently tested below EPA guidance. As further discussed in Section 8 below, the City proposes additional investigations to identify whether other schools might be similar to P.S. 199M in terms of experiencing persistent PCB air levels above EPA guidance in primary exposure areas even after light ballasts have been removed and Best Management Practices implemented.

to PCBs from all building material sources. The EPA-approved Best Management Practices are being implemented in all relevant schools on an ongoing basis.

4.1 PCB Caulk Management

Measures and practices are used to protect PCB caulk from accidental damage and identify the potential for deterioration requiring further action on an ongoing basis during school maintenance, repair and capital improvement projects (see Remedial Investigation Report, Appendix F of Appendix L Feasibility Study).

New York City Schools are operated by the DOE and maintenance of the buildings is performed by the DSF. DSF performs quarterly visual inspections of interior caulk to determine if there is any exposed caulk that is flaking, cracking, or otherwise exhibiting visual signs of significant deterioration. No sampling and analysis for PCBs in caulk is specifically required; deteriorated caulk is presumed to be PCB-containing caulk. If deteriorated caulk is identified, DSF's Environmental Health and Safety Unit (EHS) will remove and properly dispose of the deteriorated caulk.

4.2 Heating Ventilating and Air Conditioning Maintenance

The proper operation of ventilation systems is a critical component of the PCB management and control of airborne PCBs in buildings.

DSF has full responsibility for the condition, and safe and proper operation, of all heating, air conditioning, ventilating and similar equipment (collectively "HVAC") and cleans, adjusts, maintains and repairs such equipment in accordance with the requirements of the Department. DSF ensures that building air exchange rates are maintained per design, by ensuring that the HVAC and general ventilation systems are operating properly in accordance with the requirements contained in Appendix F of the Collective Bargaining Agreement. In order to optimize ventilation and air circulation, HVAC and general ventilation supply and exhaust fans are operated while schools are occupied. Heating stacks, where designed primarily for ventilation rather than heating, are used to provide tempered fresh air while buildings are occupied. The DSF maintains and adjusts this equipment, and makes minor repairs as needed. If problems are identified that are beyond the ability of the DSF to directly rectify, a work request is submitted through Passport as a Priority 4, which is an expedited priority of a time sensitive nature, with an email notification to the respective Deputy Director of Facilities.

To help ensure the building air exchange rates are maintained as per design, the DSF:

- Operates, regulates and maintains HVAC plants;
- Inspects, overhauls and repairs HVAC systems;
- Inspects and changes filters, as necessary;
- Inspects, maintains and cleans cooling systems;
- Inspects, keeps free from objects that obstruct air flow, and cleans registers;

- Inspects and cleans accessible ducts, as necessary;
- Adjusts fresh air inlet dampers on supply fans or heating stacks;
- Inspects HVAC systems annually, including circuit breakers and belts;
- Inspects and lubricates fan motors and keeps them clean. DSF also cleans any unit ventilators (aka Univents) on the outside and inside, as necessary. (This includes cleaning and oiling motor bearings, cleaning motor fans, water pans, and dampers.)

In February 2015, the City reported to EPA the possibility that long-standing deficiencies in HVAC systems may be underreported by CE/BMs, who may be focused on detecting newly occurring HVAC deficiencies. DOE has since conducted a CE/BM survey and identified ten school buildings, constructed between 1950 and 1978, that have longstanding deficiencies in their HVAC systems with no pre-existing plan for repair. DOE is currently conducting further investigations as to the scope of these deficiencies and will work to address them expeditiously.

4.3 Unit Ventilator Inspections

Starting in summer 2016, inspections of unit ventilators—individual HVAC units for classrooms—are being added to the City's BMPs. This addition was prompted by an incident that occurred in fall 2015, when the motor controller for a classroom unit ventilator smoked and leaked, triggering an investigation. Inside the unit's housing, a small stain was observed; this stain subsequently tested positive for PCBs.

DOE CE/BMs conduct annual cleaning of these units over the summer months. Going forward, as part of these BMPs, DOE will direct its custodians to inspect the interior of the unit for staining during this cleaning. If staining is found, the re-occupancy protocol designed for external leaks of light ballasts, discussed above, will be implemented. Please see the DOE Re-occupancy Protocol for Ballast Fluid Leakage Outside the Fixture or Visible Smoke Emissions From Ballasts, submitted to EPA on April 23, 2013.[10]

5. Removal and Replacement of Caulk

As presented in Section 3.5 of the BMP, capital projects to renovate schools are performed by the SCA. The SCA construction specifications have been developed to properly manage and dispose of PCB-containing caulk when it is disturbed during renovation activities. These protocols require rigorous dust control measures during the work, and cleaning and a visual inspection of the work area at the conclusion of every work shift, to minimize the potential exposure to PCB-containing dust during construction activities. In addition, window replacement project procedures have been modified to incorporate a detailed and fine cleaning of the physical spaces subject to the window removal and replacement work by a qualified environmental contractor following the replacement work and prior to re-occupancy.

[10] *See* 2014 Local Law 69 Report, at 5-6, *available at* http://www.nycsca.org/Community/Programs/EPA-NYC-PCB/PCBDocs/LL69ReportFinal11.14.14.pdf

6. Soil Evaluation, Excavation and Replacement

SCA evaluates the presence of PCBs in the surface soil within outside exposure areas (i.e., soil within ten feet of the building face), following the completion of construction projects that disturb exterior PCB-containing caulk. SCA first creates and implements a Soil Sampling Plan consistent with the SCA's Phase II Surface Soil Investigation Outline. Any surface soil ~~within ten feet of the building~~ found to contain PCBs at a concentration of greater than the EPA's one (1 ppm) guidance value will be the subject of remediation.

In accordance with 40 CFR § 761.61 and the SCA IEH PCB Soil Remediation Requirement Service Contract, Contractor General Scope of Work/Protocol and Unit Pricing, the permanent remedy to address soil exposure consists of soil excavation in all areas where PCB concentrations are identified as greater than 1 ppm in the surface soil. A Soil Remediation Plan will be created for USEPA approval and soils above 1 ppm will be remediated by excavation and offsite disposal. Confirmatory post-excavation soil results will be obtained. After removing contaminated soil, the excavation will be backfilled using clean fill. Following completion of remediation, SCA will generate a PCB Soil Remediation Report (see a sample report in Appendix J of the RIR).

7. Additional Studies

The proposed Preferred Citywide Remedy offers a reasonable approach to manage PCBs efficiently in the Relevant Schools by addressing PCB ballasts and associated light fixtures, Best Management Practices, PCB caulk, and contaminated surface soils in Outside Exposure Areas. Additional studies are recommended, however, to determine whether other schools might be similar to P.S. 199M in terms of experiencing persistent PCB air levels above EPA guidance in primary exposure areas after light ballasts have been removed and Best Management Practices implemented. Thus, the City now proposes adding the supplemental investigation described below, and discussed in further detail in an attachment to this Report, as an additional study as part of the Preferred Citywide Remedy. Additional studies of passive air sampling are also proposed, as discussed below. These studies are an addition to the remedial measures originally described in the May 2013 proposed Preferred Citywide Remedy.

7.1 Additional Air Sampling

This proposed additional study is based on the results of the Pilot Study, which showed that only one of the five Pilot Schools, P.S. 199M, demonstrated air levels consistently above EPA guidance in primary exposure areas after the light ballasts had been removed and Best Management Practices implemented. In P.S. 199M, carbon air filtration has been used to ensure that PCB air levels are consistently below EPA guidance. P.S. 199M may be unique among City schools. It is the only City school designed by its architect, and aspects of its design are uncommon among City schools. However, additional, limited sampling at other City schools can best verify whether P.S. 199M is truly an outlier as suggested by the existing evidence.

SCA reviewed the architectural plans of schools that were designed and constructed around the same time as P.S. 199M to identify other, potentially similar schools for additional, limited sampling. Attached to this Report is a Proposed Work Plan for limited, additional sampling in at

least two of these schools. Depending on the initial results, the Proposed Work Plan anticipates that two more schools may also be sampled. The results of this sampling will inform whether to add additional remedial activities at these schools and, if the investigation indicates that such additional remedial activities are appropriate, at other, similar schools, in the Citywide PCB Management Plan, in order to ensure that PCB air levels at all City schools are consistently below EPA guidance levels. The Citywide PCB Management Plan will be designed with flexibility to add such additional remedial measures in these schools and possibly other, similar schools, if necessary.

7.2 Passive Air Sampling Study

All PCB indoor air samples collected previously have relied on active or dynamic sample collection methods (EPA Method TO-10A). Typically air samples are collected for a fixed time period of 8 to 24 hours employing a sample pump fitted with sorbent media. The sampling pumps used are powered by battery or electrical line service. Data from these sampling events represent relatively short time periods.

Passive sampling devices which rely on diffusion principles can be deployed for longer sampling periods and do not require a source of power for operation. Data from use of passive sampling may be more representative of in-room PCB concentrations as passive air sampling can be deployed for longer periods of time. Also, it can be operated more cost effectively as field labor is reduced and no electrical support is needed.

A research study has been designed to assess the side-by-side performance of a passive air sampling device against an accepted active air sampling method for measuring PCB concentrations in indoor air. Two schools will be selected as the venues for this study. A total of three to five rooms per school (specifically selected as surrogates for classrooms) will be identified for the side-by-side sampling events. A large volume space (e.g., auditorium, gymnasium, and lunchroom) may be targeted as one of the test venues. The sampling events will take place over a seven to ten day period, while school is not in session. After completion of the sampling event, analysis will be performed by the EPA Region 2 Edison Lab and the relative percent difference (RPD) between the two sampling methods will be determined. A report will be produced describing the study and evaluating the suitability of passive air sampling for PCBs in schools based on study results. The contractor for this work is SCA. SCA will oversee obtainment of the samples from its subcontractor, and the subcontractor will ship samples to EPA's Region 2 Edison Lab. SCA, EPA Region 2, EPA's Office of Research and Development (ORD) National Center for Environmental Assessment (NCEA), and ORD's National Exposure Research Laboratory will participate in the interpretation and publication of the data when the analysis is complete.

8. Ventilation Upgrades

Pilot study data for P.S. 178X, which has a central HVAC system, indicates that indoor air PCB concentrations are directly affected by room and building ventilation, whereby increasing fresh air supply into the system decreases airborne PCB concentrations. Analyses performed by the USEPA predicted that airborne PCB concentrations in classrooms are directly proportional (linear relationship) to ventilation air exchange rates when there is complete room air mixing and

PCBs levels in the make-up air are zero. The typical NYC school does not have a central HVAC system, but rather classrooms are ventilated via exhaust-only ventilation systems, which were designed to draw in fresh air supply from perimeter windows. Since windows are not always open and have become more energy efficient over time, the make-up air for these classroom exhaust systems can come from within the building, and therefore room air mixing is incomplete and PCBs in the make-up air may not be zero. Pilot study data for P.S. 199M, which has an exhaust-only ventilation system, indicates that the relationship between PCB air concentrations and exhaust ventilation rates will not follow a predicted linear relationship.

In order to facilitate greater ventilation in schools, SCA is exploring potential modifications to specifications for new windows and window replacements to allow all such windows to be opened from the top.

Ventilation rates measured in two (2) schools with exhaust-only ventilation systems (P.S. 199M and P.S. 309K) were found to be below the design rates in certain rooms and areas. SCA has subsequently repaired/replaced the ventilation equipment and controls at these schools. Strategies for ventilation improvement, with particular focus on improvement in fresh air supply, may need to be evaluated further based on the results of the long-term air monitoring and the additional air sampling. As this is a complicated issue, an architect and/or engineer may be needed to make recommendations for improvements to building ventilation, and additional air monitoring will be needed to establish a direct relationship between ventilation rates and airborne PCB concentrations after recommended improvements have been implemented. The positive impacts of improved ventilation strategies on indoor PCB concentrations need to be better documented to understand their effectiveness.

9. Long Term Monitoring

In April 2014, EPA approved the City's Long-Term Monitoring Work Plan for the five (5) Pilot Schools (P.S. 178X, P.S. 199M, P.S. 309K, P.S. 183Q and P.S. 3R). Long-term monitoring is currently continuing according to this USEPA-approved plan to evaluate the effects of remedial measures implemented during the Pilot Study.

The approved program of long-term monitoring included bulk and wipe sampling at four (4) schools (P.S. 178X, P.S. 183Q, P.S. 199M and P.S. 309K). The sampling targeted locations where 2010 replacement caulk was found to contain less than 50 ppm of PCBs, and new locations where 2011 replacement or encapsulated caulk had not been sampled. Sampling of 2011 exterior encapsulated caulk at P.S. 178X and P.S. 199M, and 2011 replacement caulk for new windows installed at P.S. 183Q, was also included. A list of specific materials and locations for sampling is included in the approved Long-Term Monitoring Work Plan.

This bulk and wipe sampling contemplated in the Work Plan have concluded. The results of the bulk sampling suggest that PCBs in underlying substrates have migrated into and contaminated the replacement caulk. Results also suggest that, in general, higher PCB concentrations in the original caulk are associated with higher concentrations of PCB contamination in the replacement caulk and that the concentration of PCBs in replacement caulk tends to increase over time. The overall extent to which PCBs penetrate and migrate from underlying substrates into replacement caulk appears to be variable. This is likely due to multiple factors including

differing substrate materials, substrate PCB concentration variability and variability of replacement caulk application techniques as well as sampling and analytical variability inherent in the methodologies.

The results of the wipe sampling indicate that PCBs from underlying PCB-containing caulk appear to migrate, at varying rates, through the encapsulants that were utilized. In addition, higher surface PCB concentrations were associated with higher concentration caulks.

As for the long-term air sampling, PCB air samples were collected at each of the five (5) Pilot Schools on a semi-annual basis (once during the heating system in February and once in the non-heating season, in the second half of September). Nine (9) area samples, one (1) front/back sample to evaluate sampling collection efficiency, one (1) duplicate sample, and one (1) ambient air sample for comparison purposes were collected at each building during each round of testing. The results of the PCB air samples were compared to USEPA's indoor air guidelines for school buildings, based on the ages of building occupants, as well as with the previous post-remediation air sampling events (comparison of mean PCB air concentrations) at each of the five (5) Pilot Schools.

At P.S. 183Q, air samples collected in October and December of 2014, in three transitory areas, were found to be above EPA's guidance values. However, none of the samples collected in any of the primary exposure areas were found to be elevated. Prior to this round of testing, the last air sampling at P.S. 183Q, conducted in December 2013 showed PCB levels within EPA guidance in the areas sampled. In addition, prior results have shown general improvement across sampled areas in P.S. 183Q following remediation. Until two (2) consecutive rounds of air sampling show concentrations below EPA air guidance values, additional follow-up monitoring will continue at P.S. 183Q.

Recent air samples collected at P.S. 199M, during both the heating and non-heating seasons (specifically, in May 2013; September 2013; February 2014; June 2014; September 2014; and February 2015), were below EPA guidance values; however, carbon filtration systems continue to operate at this school to aid in reducing airborne levels of PCBs. Air sampling performed in May 2014 in P.S. 199M without the carbon air filtration units running, showed that seven (7) of twenty-two (22) locations sampled (which included twenty (20) primary exposure areas) were slightly above EPA guidance levels. Until two (2) consecutive rounds of air sampling show concentrations below EPA air guidance values during normal building operating conditions without carbon filtration, additional follow-up monitoring will continue at P.S. 199M.

Air sampling results at P.S. 178X, P.S. 309K, and P.S. 3R, during both heating and non-heating seasons, were all below applicable EPA guidance values. Samples were collected while these buildings were operating under typical occupancy conditions. In accordance with the long-term monitoring plan, sampling can be suspended at P.S. 178X, P.S. 309K and P.S. 3R, since two (2) consecutive rounds of air sampling results were within EPA's air guidance values. Therefore, additional PCB air sampling will not be performed in these schools.